

Defense Energy Security from a Social-Ecological Systems Perspective

Or:

How to do the long trip
when you can't read the fuel gauge

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Agenda

- Energy resource concerns
- Context within natural resource management theory
- Systems perspective for understanding the uncertainties and mission vulnerabilities
- Adapting to stay resilient

Bottom Line Up Front

- The most important factor in energy security is RESILIENCE
 - Vulnerability in narrow resource dependency
- We can learn from nature: Resilient ecosystems are sustainable
- We need adaptive strategies to achieve defense energy resilience
- If we only plan for new energy sources, we are not addressing the underlying problem

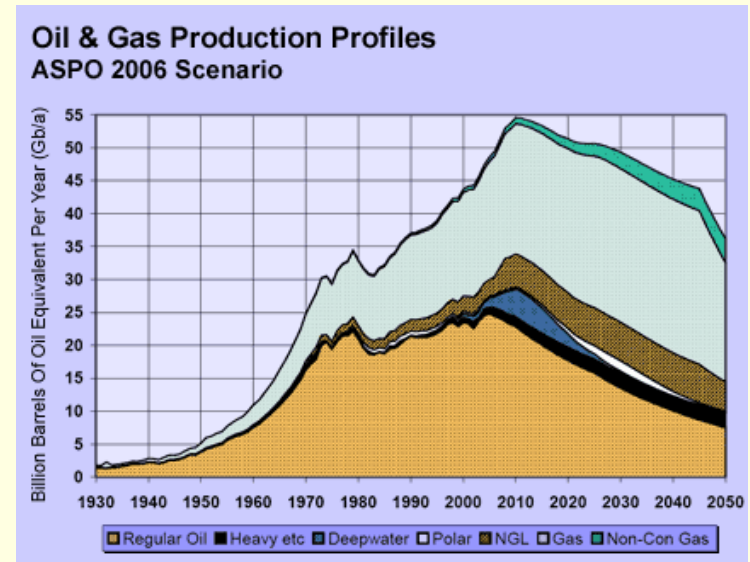
Energy Resource Concerns

- Below ground
- Above ground
- Systemic over-reliance
 - Nationwide
 - Military



Energy Resource Concerns: Below Ground

- Hubbert's Peak
- National Petroleum Council meta-study on outlook to 2030
 - Enough “molecules in the ground,” BUT
 - US cannot rely on Saudi Arabia to make up shortfalls
- Numerous studies projecting peak within 10-20 years



Energy Resource Concerns: Above Ground

- Even “adequate” supplies not sufficient:
Many threats to access
- NPC study sites “accumulating risks”
 - Political
 - Economic
 - Environmental
 - Military
 - Infrastructure
- Takes decades to adjust resource base

Energy Resource Concerns: Systemic Over-Reliance - Nationwide

All public sectors...

- Agriculture
- Industry/manufacturing
- Transportation
- Health
- Safety
- Etc.

...rely on very few
energy resources

- Oil
- Coal
- Natural gas

**Even minor shortfalls quickly cause big
problems, price swings, and anxiety**

Energy Resource Concerns: Systemic Over-Reliance - Military



- Oil is a GREAT fuel
 - Great energy density, transportability, store-ability
 - Enables power, agility, & lethality
 - Easy to get hooked!

Energy Resource Concerns: Systemic Over-Reliance - Military

- “Just a logistics problem”
 - Assumed to be available anywhere, any time, in whatever form and quantity is needed
 - Military purchasing power relies on suppliers worldwide
 - What were once “wants” are now “needs”
- Missions planned, equipment acquired, force structured & trained based on assumed supply
- Without energy resilience, missions unsustainable

Understanding the Mission Vulnerabilities

- Thought experiment:
What happens if we start turning off the tap?
- Consider changes in resource availability
 - Slow or rapid onset?
 - Short-lived or permanent?
 - Affecting quantity, type, quality, and reliability
- What mission capabilities suffer?
- What are secondary and cascading effects?
 - Less energy available to address the problem
- Does effect on nation distract or alter military missions?
- Can effects be mitigated?



The Ecological Example: Understanding the System

■ Resilience Theory

- Amount of disturbance that system can absorb without changing structure, feedbacks, function, overall ID
 - “Things are pretty much status quo,” versus
 - “The world no longer looks familiar”
- Stability regimes driven by “slow variables”
 - E.g., energy resource supplies
- Bounded by thresholds
 - Can resource keep up with demands?

Slow Variables and Thresholds

- Clear Lake → Cloudy, eutrophic lake
 - Variable - phosphorus accumulation in sediment
 - Threshold – low dissolved oxygen levels causing P release into water column
- Norse Settlements in Greenland*
 - Variable - climate - temperature
 - Threshold – level at which unable to raise crops and maintain livestock
- Energy Security
 - Variable – regional fuel availability
 - Threshold – level at which missions compromised

Adaptive Cycle

Growth and Predictability

Cheapest - Global resources economically optimized

Conservation

Crash - Unable to access needed resources, unprepared to engage adequate alternatives

Release

Rapid Growth

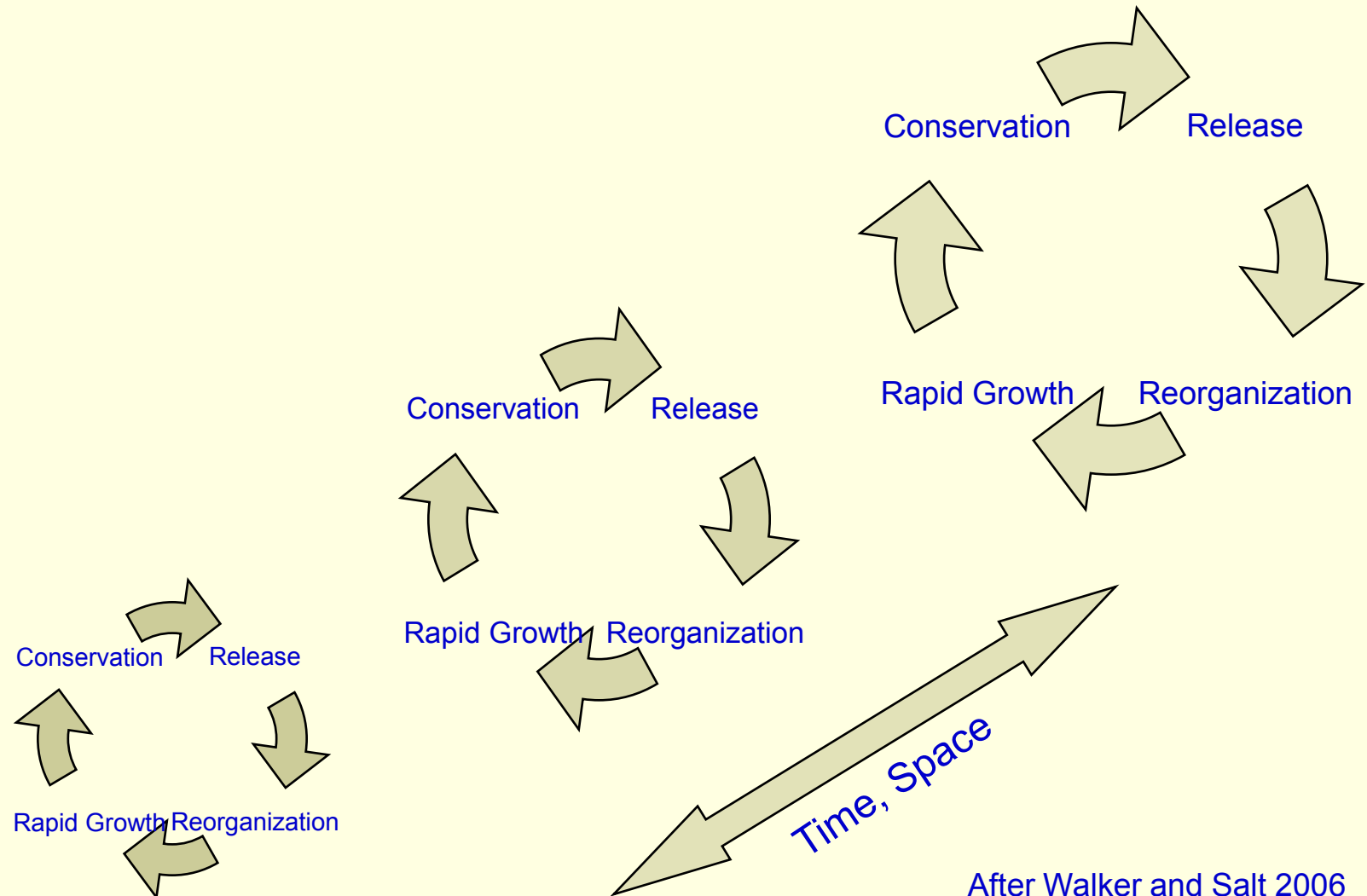
Easiest - Local energy, exploiting „low hanging fruit“

Reorganization

Rethinking - Rediscovery of local, diverse resources, adaptation to new resource limits

Creative Destruction

Adaptive Cycles at Multiple Scales



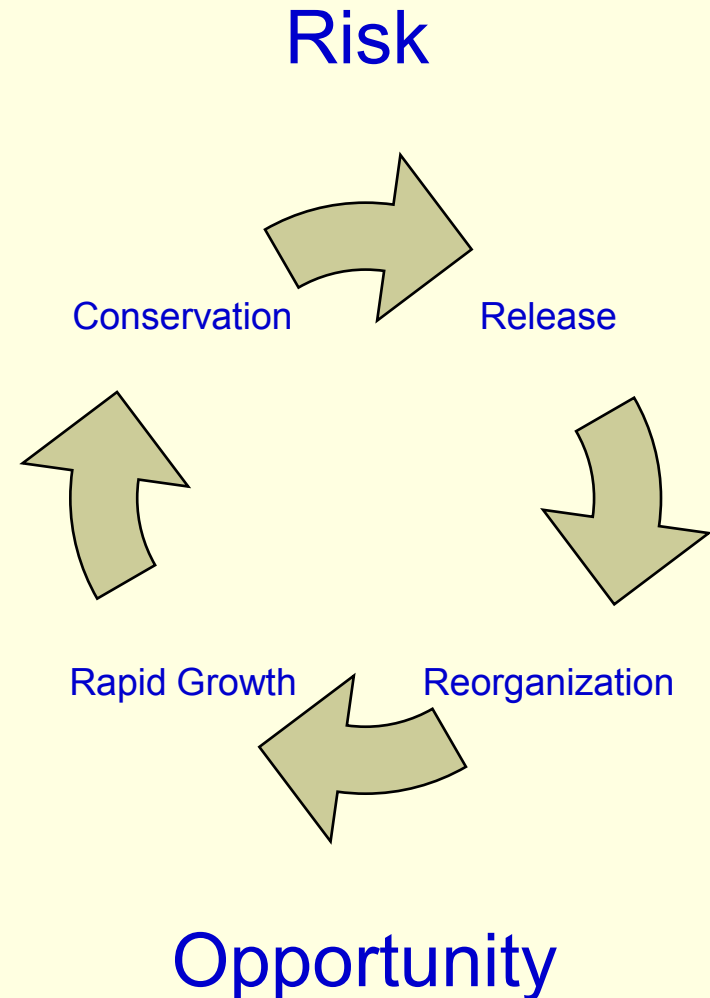
After Walker and Salt 2006

Addressing Uncertainties

- Adaptive Management
 - Policy as experiment
 - Premise – systems are dynamic!
 - Seek resilience in face of surprise
 - Test hypotheses about system behavior
 - Adjust policies and try again
 - *“Learning is a long term proposition that requires ballast against short-term policies and objectives” (Lee 1993).*

Adapting to Stay Resilient

- Understand location within Adaptive Cycle
 - *Risk* - greatest in Conservation & Release phases
 - *Opportunity* - greatest in Reorganization & Rapid Growth



Adapting to Stay Resilient

- Use adaptive management to explore
 - Cross-scale effects
 - Key variables at higher & lower scales
 - Thresholds
 - Anticipate breaches
- Avoid “mono-culture” mentality
 - Less resilient – less “response diversity”
 - Optimization for 1 resource or condition lowers overall resilience
 - Tight control can hasten collapse

Resilience Management Questions

- What linkages between scales drive system?
 - Are we monitoring the right variables?
- Do our policies explore system bounds (thresholds)?
- How should system be managed to avoid breaching thresholds?
 - Do we avoid perverse subsidies? Do incentives promote inflexible or counterproductive behavior?
 - Can Conservation Phase be perturbed to move back into Rapid Growth Phase (avoiding Release)?

Resilience Management Questions (cont.)

- Can thresholds be elevated or moved?
- Can energy source diversity be increased?
- How do we build institutional capital to increase resilience?
 - Financial capital
 - Capacity to innovate
 - Adaptive management approach to learning
 - Organizational memory
 - Response diversity

Conclusions

- We can enhance security by increasing the resilience of our energy programs
- We can gain useful perspective from natural resource management theory to assist in this task
- Resilience Theory provides the context
- Adaptive Management provides the framework

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Questions?